

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

BEST AVAILABLE COPY

| | | |
|---|---|---|
| Applicant's or agent's file reference 9555WO/JS | FOR FURTHER ACTION See Form PCT/IPEA/416 | |
| International application No. PCT/SE2004/001316 | International filing date (day/month/year) 13-09-2004 | Priority date (day/month/year) 26-09-2003 |
| International Patent Classification (IPC) or national classification and IPC H02J 3/22, H02J 3/18 | | |
| Applicant ABB Research Ltd et al | | |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|--|-------------------------------------|---|---------------------|--------------------------|------------|----------|--------------------------|-------------|--|--------------------------|------------|----------------------------|-------------------------------------|-----------|---|--------------------------|------------|-------------------------|-------------------------------------|-------------|--|--------------------------|--------------|---|
| <p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>4</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p style="margin-left: 20px;">a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <u>3</u> sheets, as follows:</p> <div style="margin-left: 40px;"> <input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. </div> <p style="margin-left: 20px;">b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p> | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>4. This report contains indications relating to the following items:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 10%;"><input checked="" type="checkbox"/></td> <td style="width: 30%;">Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> | <input checked="" type="checkbox"/> | Box No. I | Basis of the report | <input type="checkbox"/> | Box No. II | Priority | <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability | <input type="checkbox"/> | Box No. IV | Lack of unity of invention | <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement | <input type="checkbox"/> | Box No. VI | Certain documents cited | <input checked="" type="checkbox"/> | Box No. VII | Certain defects in the international application | <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. II | Priority | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. VI | Certain documents cited | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Box No. VII | Certain defects in the international application | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application | | | | | | | | | | | | | | | | | | | | | | |

| | |
|---|--|
| Date of submission of the demand 14-04-2005 | Date of completion of this report 18-10-2005 |
| Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88 | Authorized officer Sara Thulin/MN Telephone No. +46 8 782 25 00 |

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2004/001316

Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____
which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1 - 19 as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- pages 21, 22, 24, 25 as originally filed/furnished
- pages* 20, 23 as amended (together with any statement) under Article 19
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the drawings:
- pages 1 - 8 as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

BEST AVAILABLE COPY

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2004/001316

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

| | | | |
|-------------------------------|--------|-------------|-----|
| Novelty (N) | Claims | <u>1-41</u> | YES |
| | Claims | | NO |
| Inventive step (IS) | Claims | <u>1-41</u> | YES |
| | Claims | | NO |
| Industrial applicability (IA) | Claims | <u>1-41</u> | YES |
| | Claims | | NO |

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

D1: WO 02073767 A1
D2: EP 0954082 A2
D3: US 5349283 A
D4: US 3955134 A

The combination of D1 and D2 does not lead a person skilled in the art to the claimed invention, since D1 would lead a person skilled in the art away from the claimed invention according to new Article 19 claims.

Therefore, the claimed invention is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-41 is novel and is considered to involve an inventive step. The invention is industrially applicable.

BEST AVAILABLE COPY

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2004/001316

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

The drawings do not fulfil the requirements of PCT Rule 11.11, "the drawings shall not contain text matter, except a single word or words, when absolutely indispensable".

BEST AVAILABLE COPY

Art 19 bis

PATENT COOPERATION TREATY

17-06-2005 20

PCT

BIBL

From the INTERNATIONAL BUREAU

NOTIFICATION CONCERNING WRITTEN
OPINION OF THE INTERNATIONAL SEARCHING
AUTHORITY AND AMENDMENTS OF CLAIMS(PCT Rule 62 and
Administrative Instructions, Section 417(d))

To:

Swedish Patent Office
P.O. Box 5055
S-102 42 Stockholm
Sweden

in its capacity as International Preliminary Examining Authority

Date of mailing (day/month/year)

08 June 2005 (08.06.2005)

International application No.

PCT/SE2004/001316

International filing date (day/month/year)

13 September 2004 (13.09.2004)

Applicant

ABB RESEARCH LTD et al

The International Bureau hereby transmits a copy of the amendments to the claims under Article 19 together with any accompanying statement (Rule 62.1(ii)).

BEST AVAILABLE COPY

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 338.70.90

Authorized officer

Eric VUAGNIAUX

Telephone No. (41-22) 338 9768

CLAIMS

1. A high voltage AC transmission cable system (1) for transmitting power between two points (A, B) each connected to
5 one or more power networks wherein at least one transformer is arranged at each end of an AC transmission cable, characterised in that at least one said transformer (3_A, 3_B) is arranged with a voltage control member capable of operating the transformer at a voltage dependent on the surge impedance of
10 the cable (Z_v) whereby losses due to reactive power transport are minimized.
2. A system according to claim 1, characterised in that the system comprises a control member to operate said system
15 at an optimal voltage dependent on the surge impedance of the cable (Z_v) and the instantaneous power level.
3. A system according to claim 1, characterised in that the system comprises a control member to operate said system
20 at an optimal voltage dependent on an instantaneous power level equal to the Natural Load ($P_{natural}$) of the cable.
4. A system according to claims 1, characterised in that the system comprises a control member to operate said system at a
25 voltage whereby the sum of the resistive losses, dielectric losses and charging losses are minimized.
5. A system according to any of claims 1-4, characterised in that the control member is arranged for communication with
30 control equipment at both ends of said AC transmission cable.
6. A system according to any of claims 1-5, characterised in that the control member is arranged with control instructions for operation of said AC transmission cable under thermal
35 overload conditions during limited periods of time.

24. A system according to claim 1, characterised in that the cable system shield may be equipped with transposings and sheath sectionalizing insulators reducing shield induced currents.

5

25. A system according to claim 1, characterised in that at one end of the cable reach may be connected to one or more electrical machines (11) isolated from the rest of the system.

10 26. A system according to claim 25, characterised in that a transformer (10) arranged nearest the electrical machines (11) has a fixed transformation ratio or is equipped with off-load tap-changers only.

15 27. A system according to claim 25, characterised in that voltage regulation of the machines (11) is controlled according to the same natural load and minimize losses principle as it would be applied to a tap changer.

20 28. A method to control a high voltage AC transmission cable system for transmitting power between two points (A, B) connected to one or more power networks wherein at least one transformer (3_A , 3_B) is arranged at each end of an AC transmission cable (4), characterised by operating the cable
25 with a variable voltage (V) dependent on the surge impedance of the cable (Z_V) which may differ from a voltage of said one or more power networks.

30 29. A method according to claim 28, characterised by regulating the voltage dependant on a function of the natural load of a said AC transmission cable, and so controlling the level of reactive power transported into any of said one or more power networks.